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B25F 3/00

(52) UK CL (Edition R )
B3C C1A4C C1A4E C1A8H1

(56) Documents Cited
GB 0890368 A US 5022131 A US 4945790 A

(58) Field of Search
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Online: WPI,EPODOC

(54) Abstract Title
**Power tool with multiple chucks**

(57) The present invention relates to a power tool, in particular to a power drill comprises a plurality of parallel longitudinal open tubes a,b,c,d arranged for rotation about a longitudinal axis within a housing 25. Each longitudinal tube houses a chuck 31a assembly, mounted for axial movement therein. Each chuck assembly is selectively operatively couplable with a drive means. The chuck assemblies are each spring loaded into their respective tubes and only protrude when in the working position as shown with chuck 31a when engaged with the drive means.

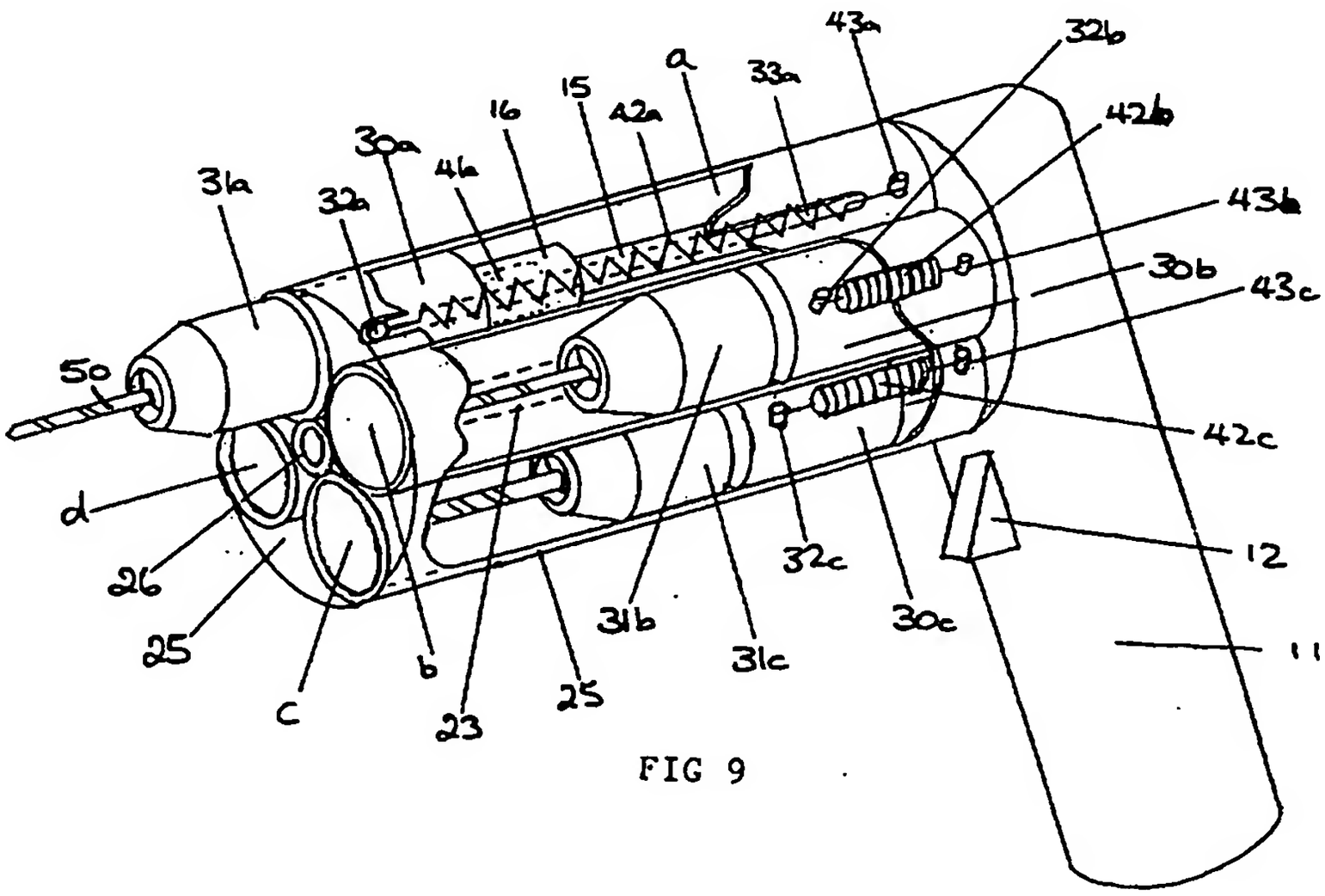


FIG 9

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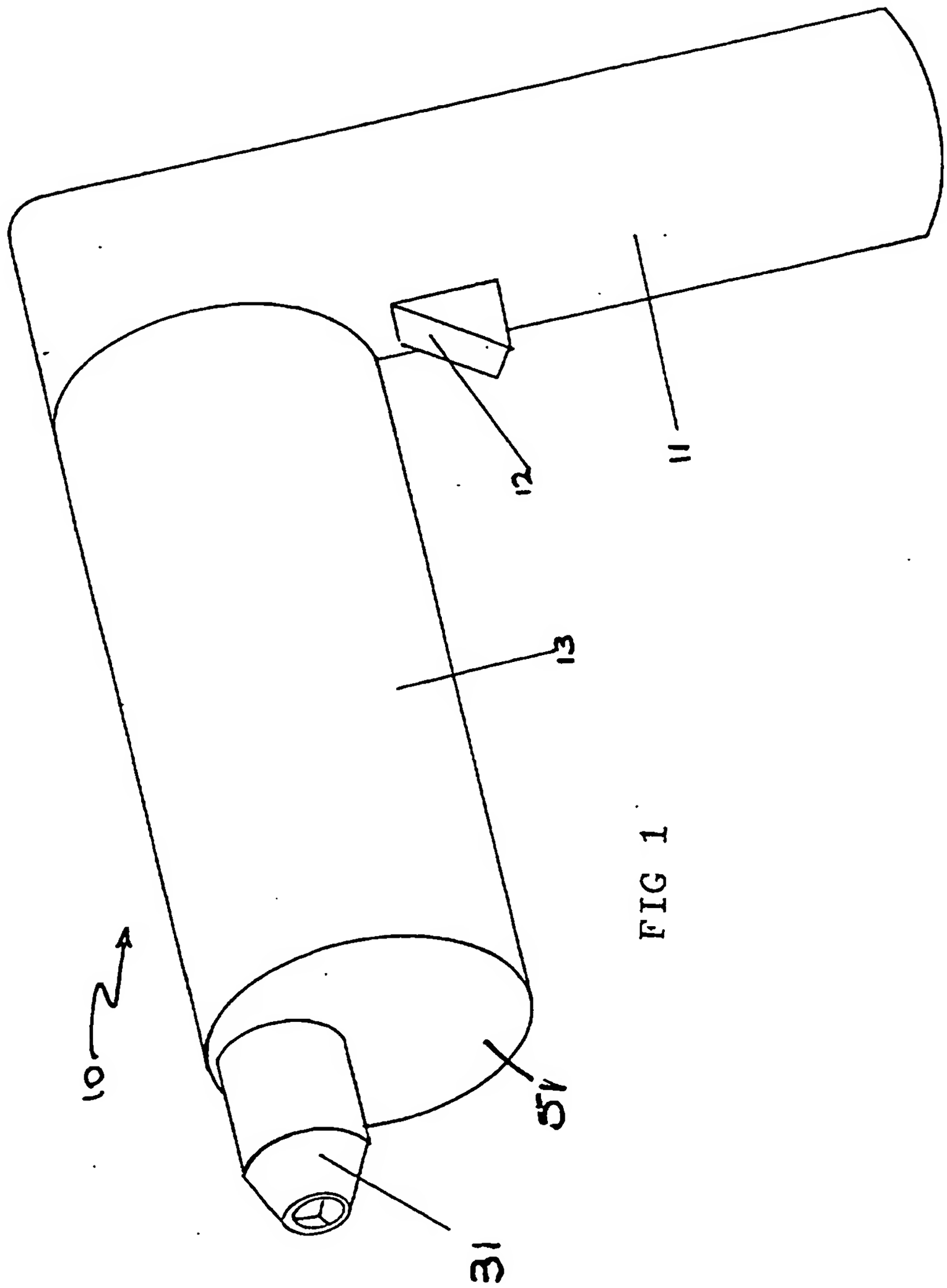



FIG 1

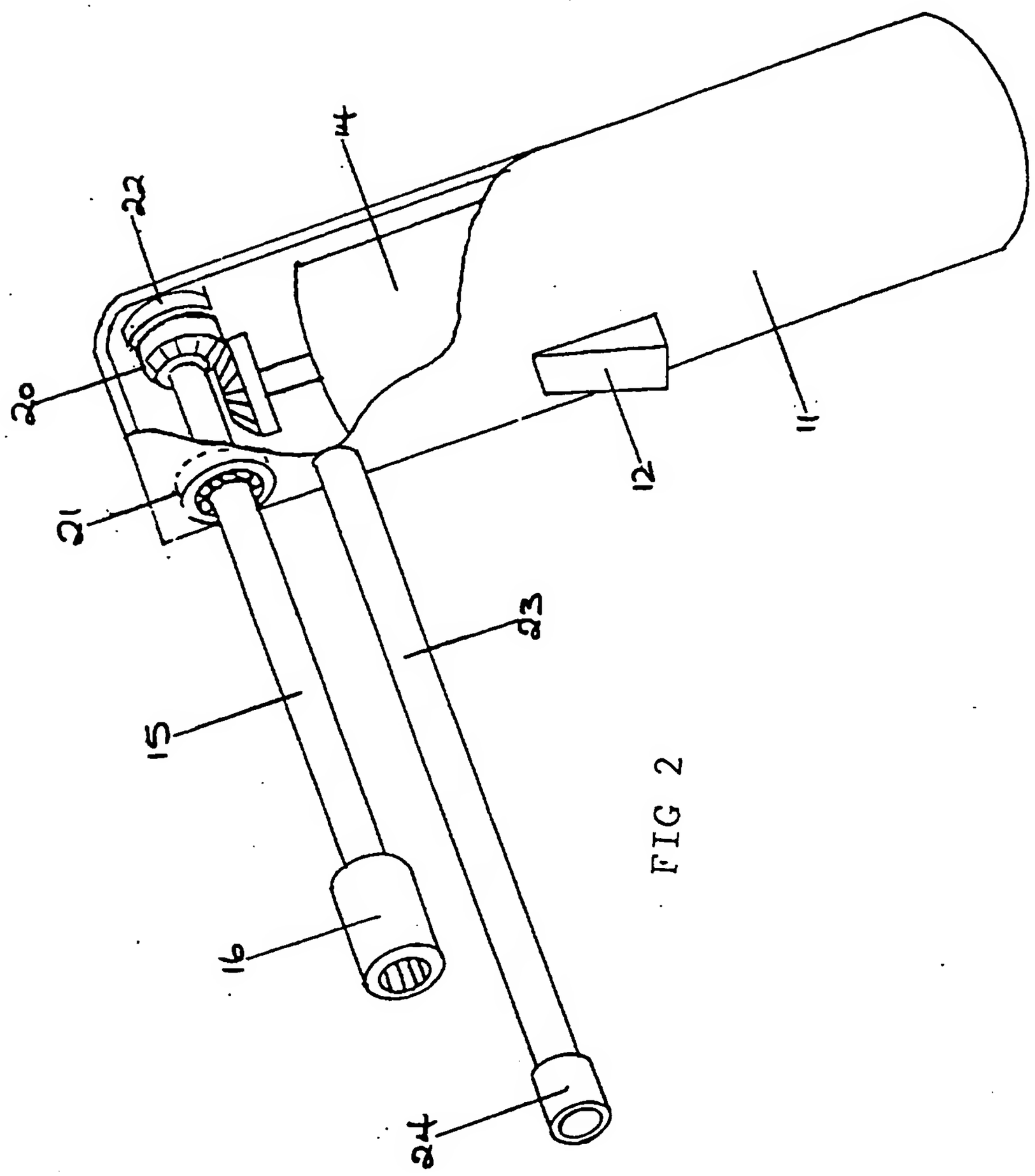



FIG 2

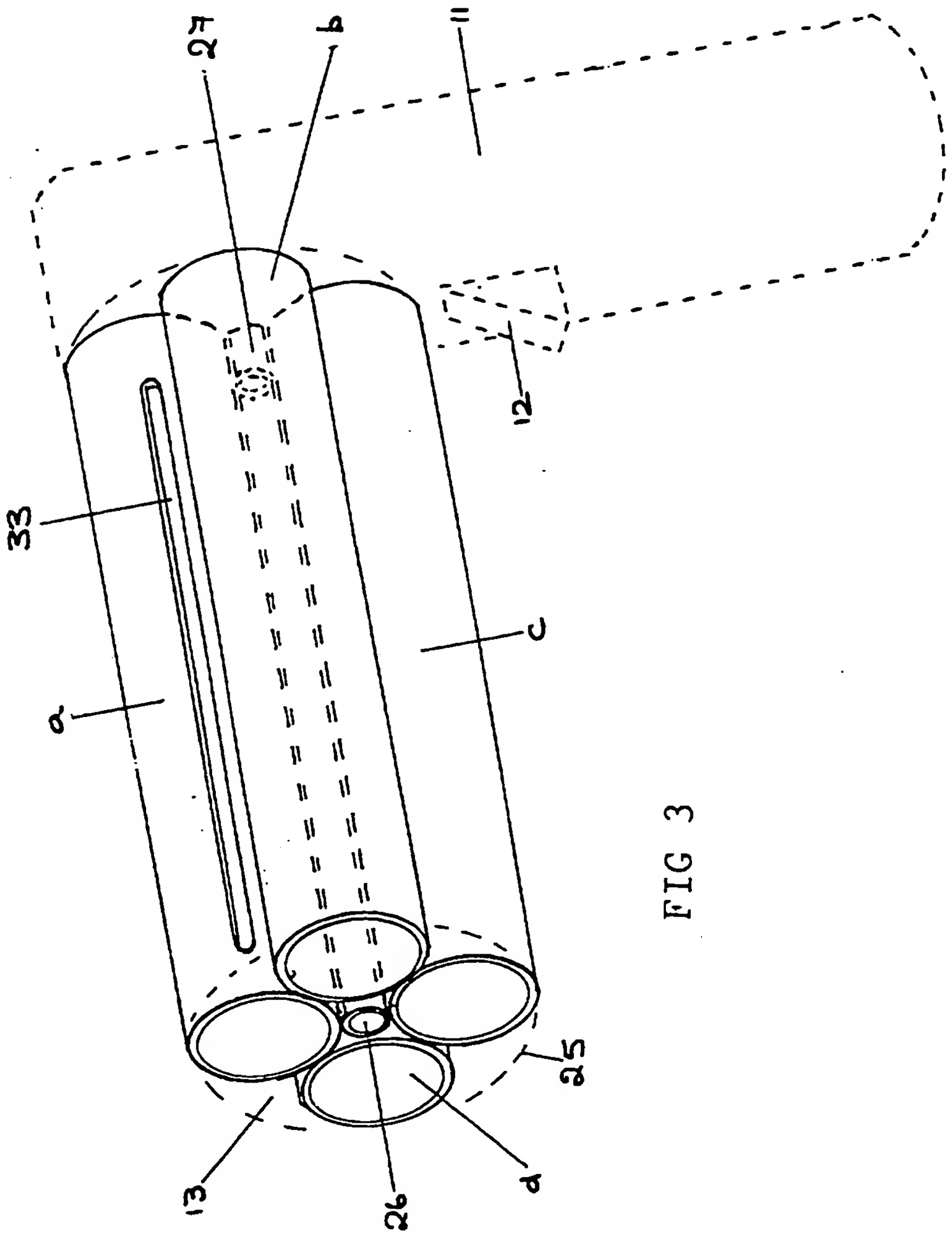



FIG 3

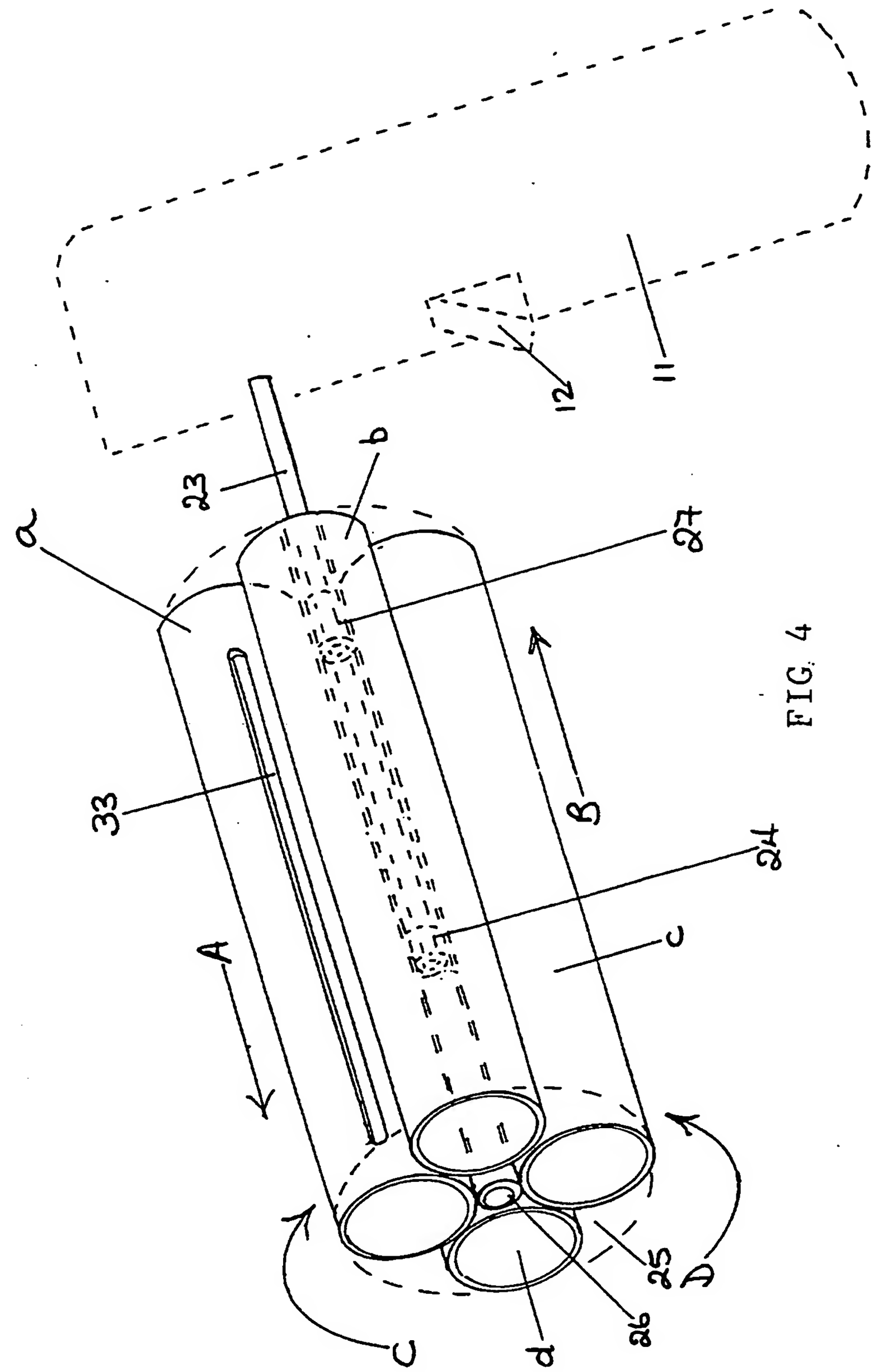



FIG 4

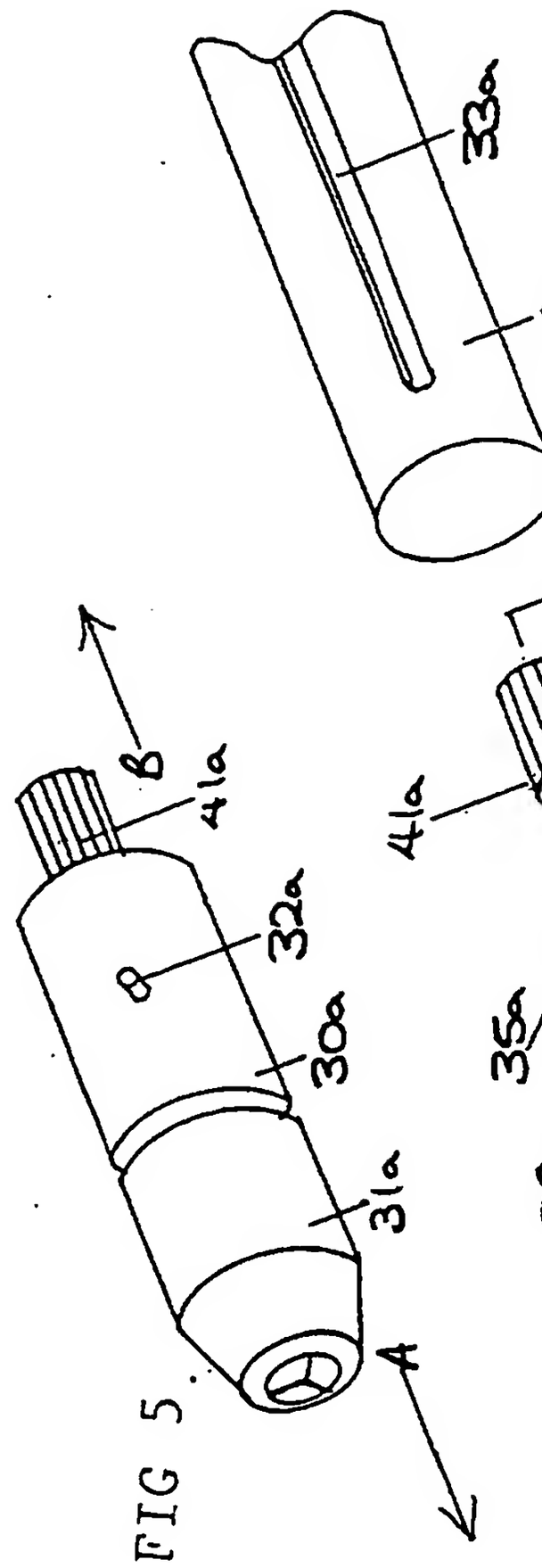



FIG 5




FIG 6




FIG 7

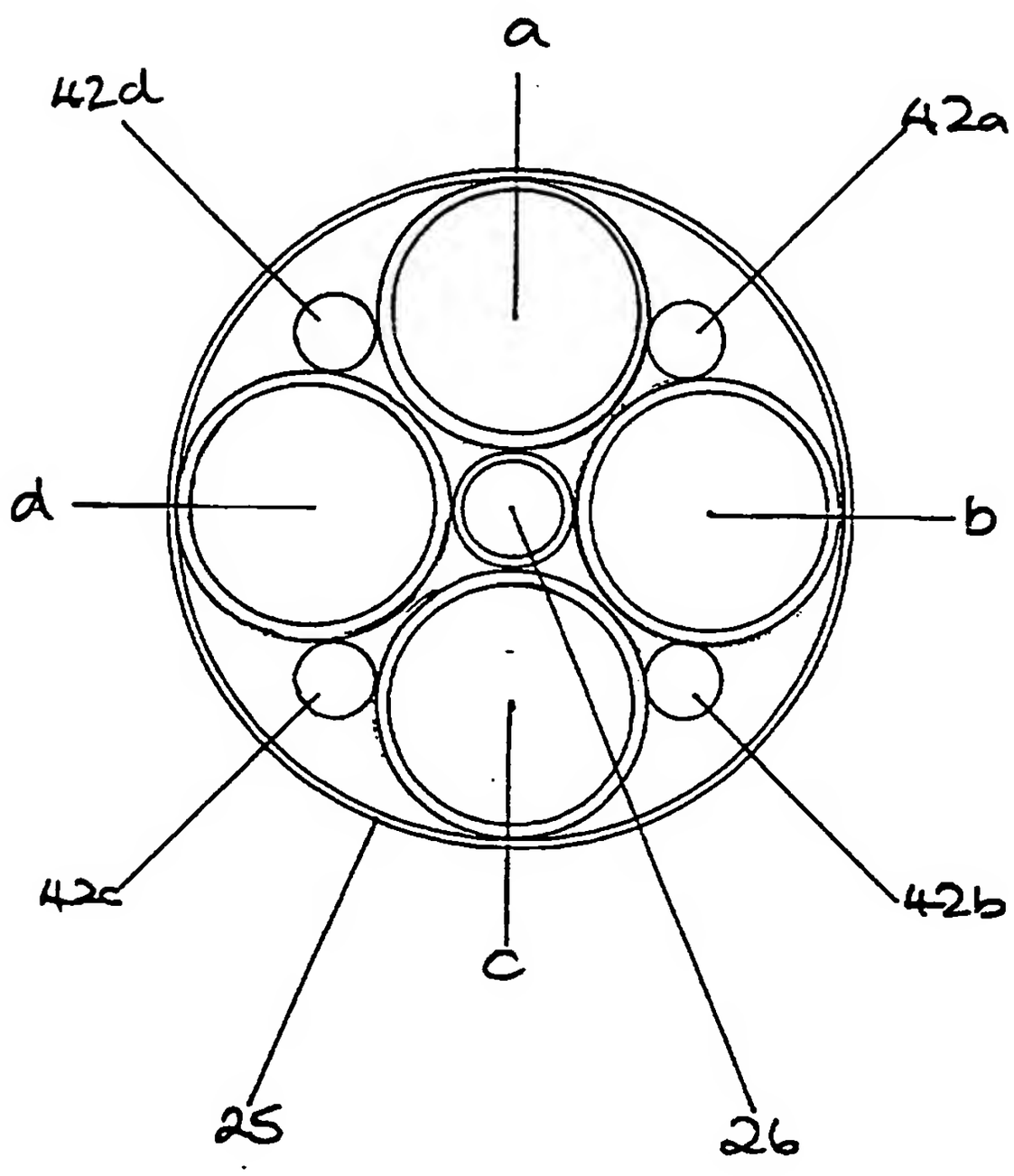



FIG 8

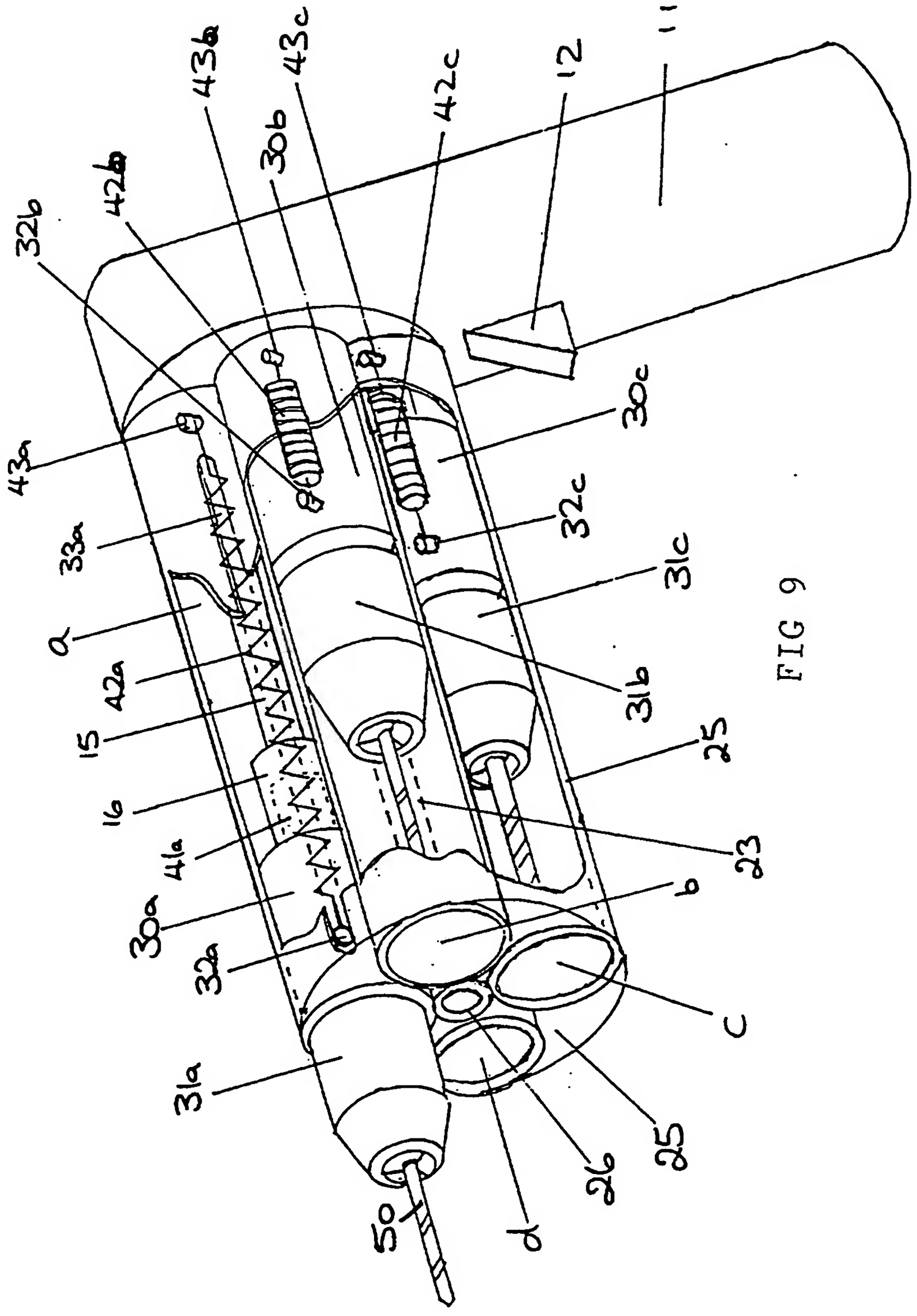

43b
43c
42c
12
11
32b
42b
30b
43a
30c
32c
33a
31c
Q
42a
31b
15
25
16
23
41a
30a
32a
b
c
31a
26
25
50
d

FIG 9

FIG 10

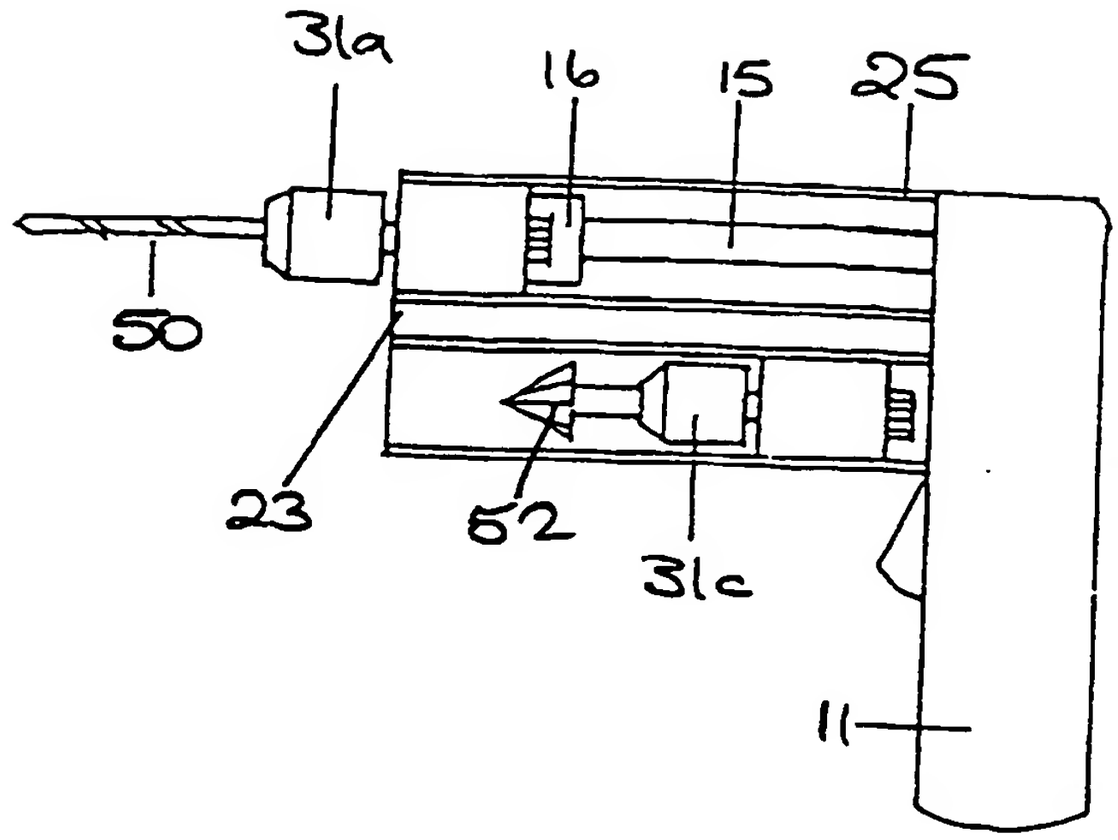



FIG 11

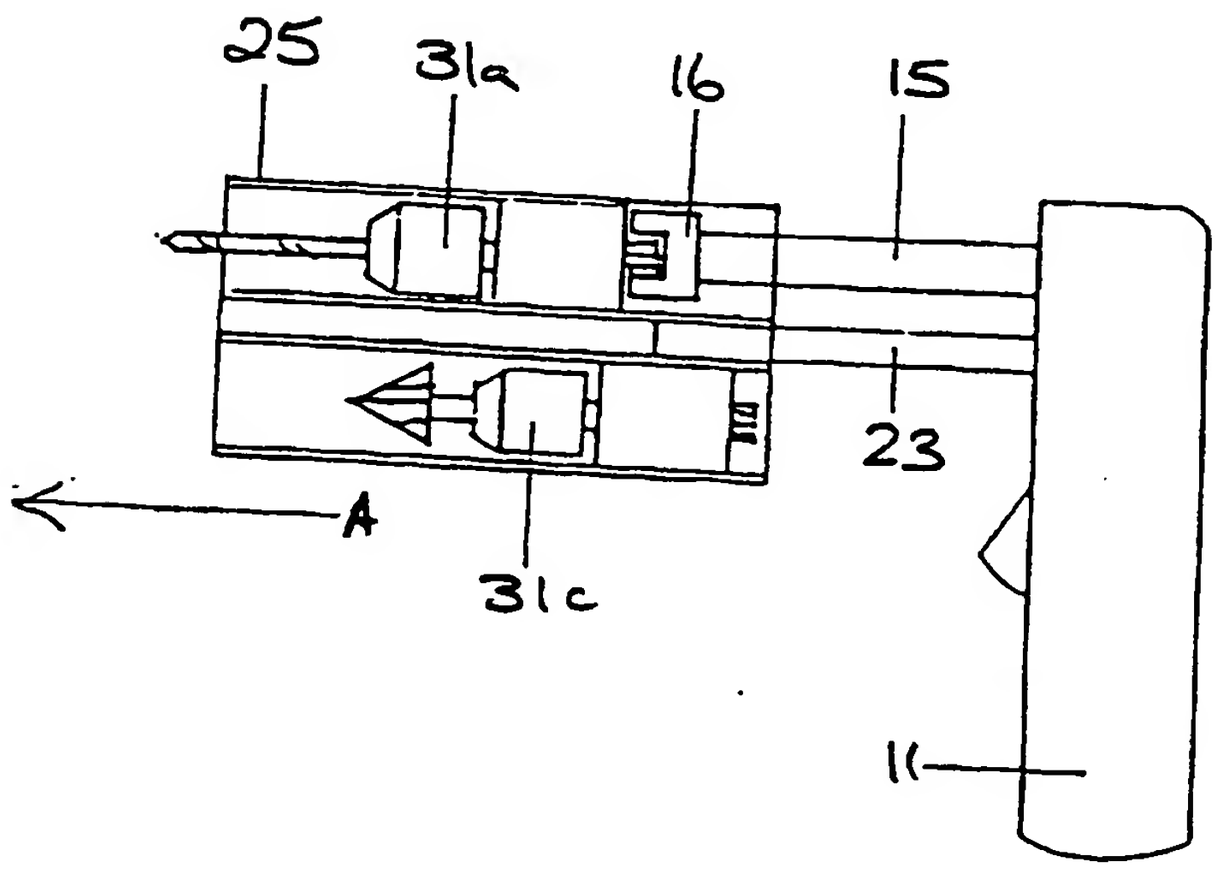



FIG 12

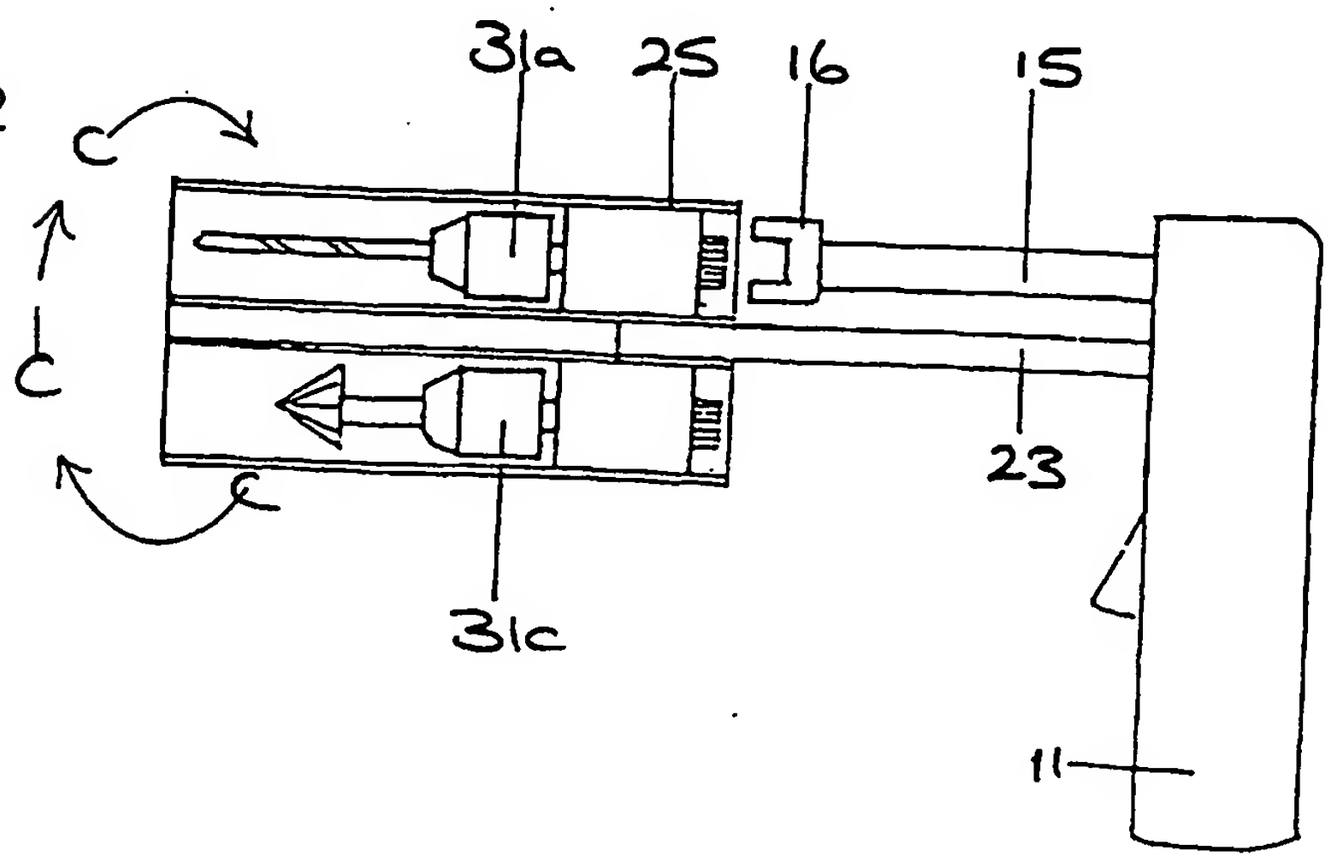


FIG 13

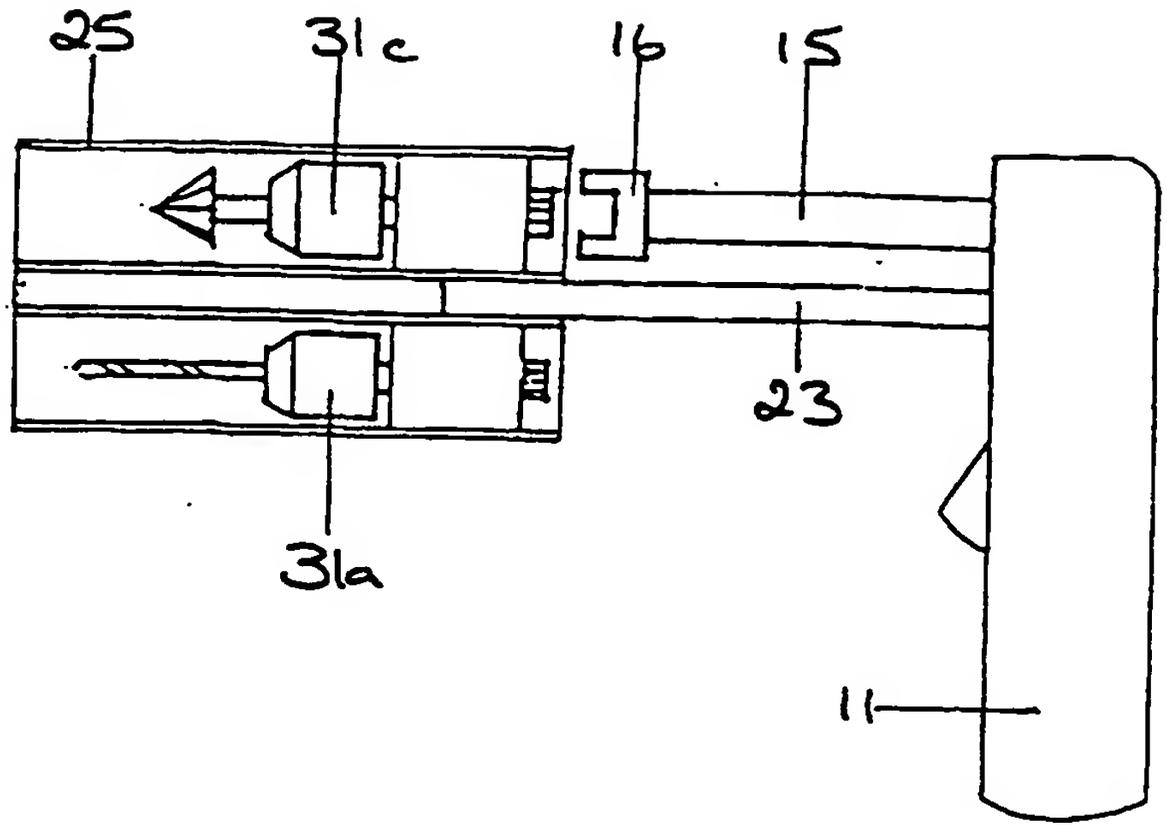



FIG 14

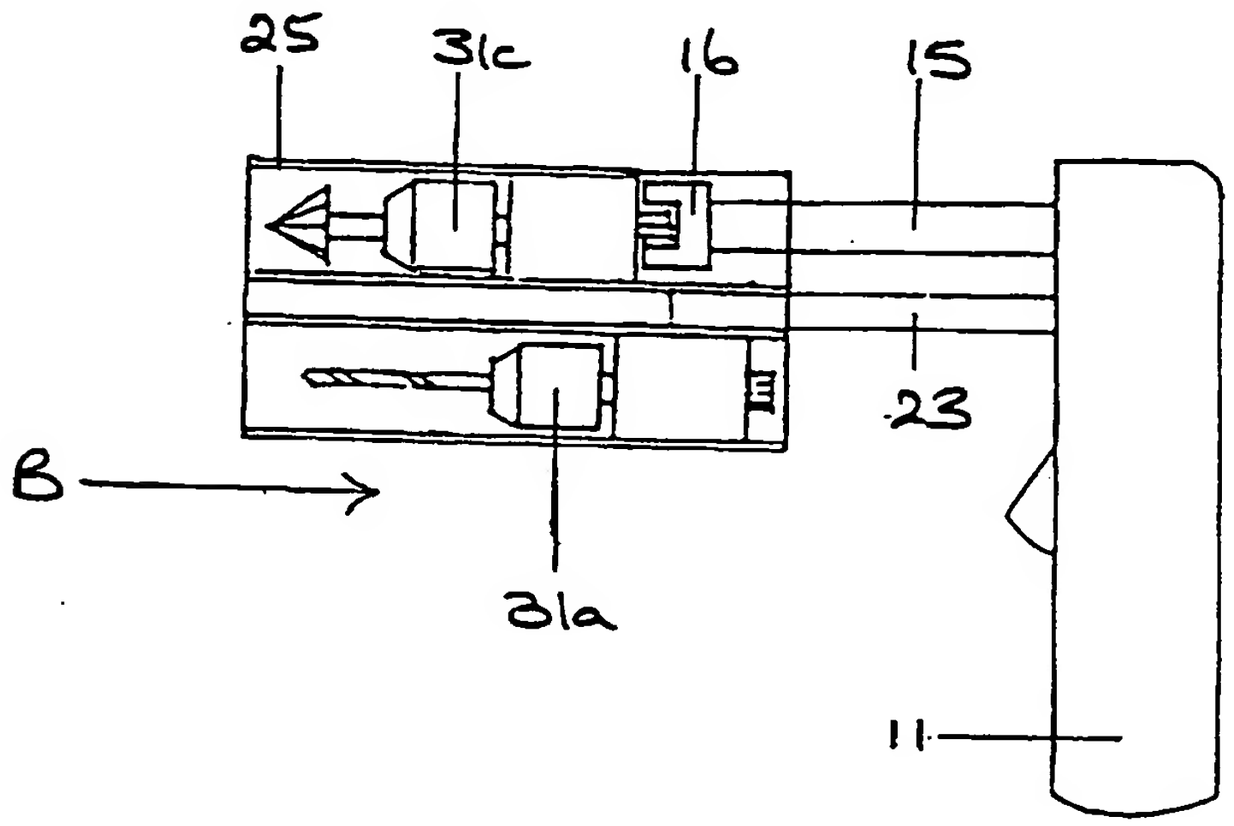
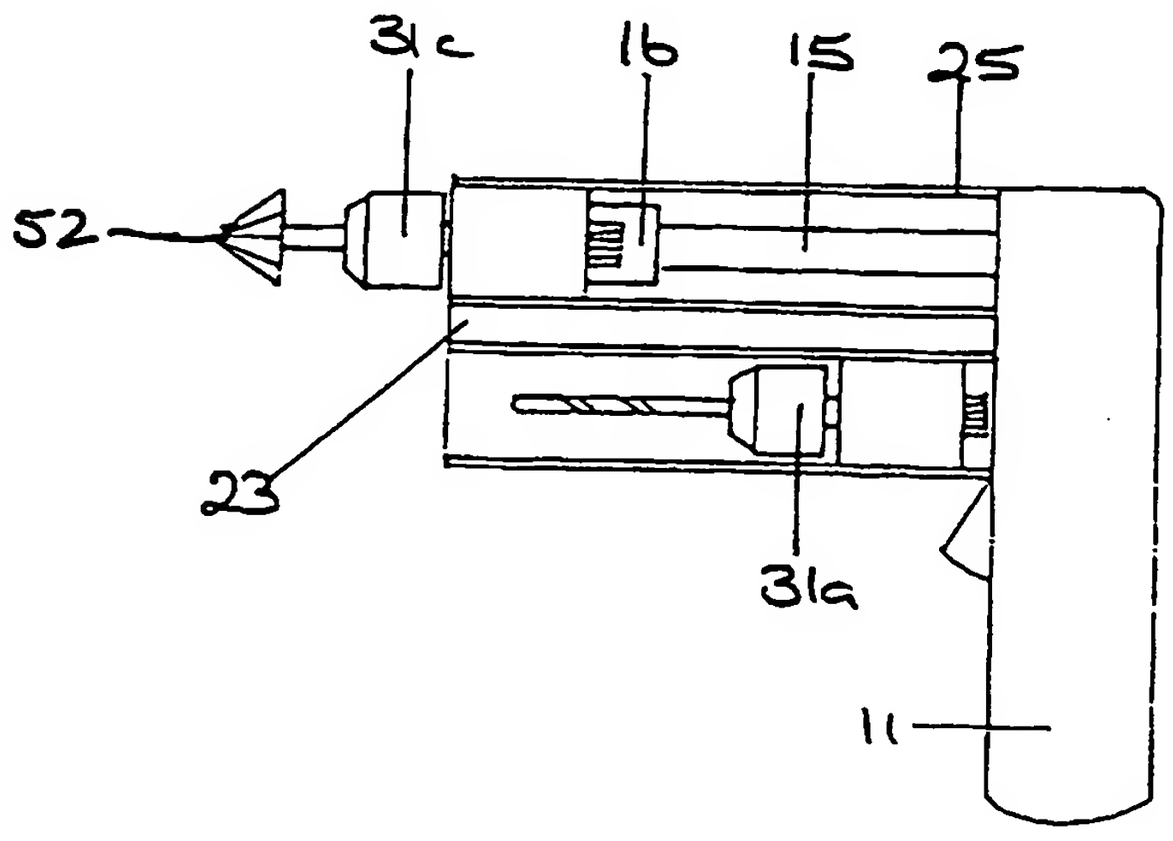



FIG 15



# POWER TOOL

The present invention relates to a power tool, in particular to a power drill.

Conventional portable power drills include a single chuck or collet (the terms are intended here to be synonymous) designed to hold various working implements such as drill bits or screwdriver bits and the like. During the course of normal use it is often necessary to change the working tool, for example from a small diameter bit for drilling a pilot hole; to a larger diameter bit for drilling the hole of the size required; to, perhaps, a countersinking drill bit; and finally to a screwdriver bit. Whilst power drills are very efficient at performing useful work once the chuck has been "loaded", they suffer from the disadvantage of stoppage time leading to operator frustration whilst exchanging bits etc. This is particularly the case when engaged upon repetitive work where bits have to be exchanged repeatedly.

In its broadest sense, the present invention provides a power tool comprising a plurality of parallel longitudinal open tubes arranged for rotation about a longitudinal axis within a housing; wherein each longitudinal tube houses a chuck assembly, mounted for axial movement therein, each chuck assembly being selectively operatively couplable with a drive means.

Preferably each chuck assembly comprises a cylindrical body having an axial spindle passing therethrough with a chuck mounted at a front end of the spindle.

Preferably the drive means comprises a motor operatively coupled to a drive shaft, the drive shaft and the rear end of each spindle including cooperative engagement means. Typically, the cooperative engagement means comprises a spigot and a spline.

Preferably, each chuck assembly cylindrical body includes a peg projecting radially therefrom engaging an elongate axial slot in the longitudinal tube.

Preferably, a spring is coupled between the each peg and a respective anchor point provided on the respective longitudinal tube. Preferably, the spring is an expansion spring and the anchor point is located at a point towards the rear of the longitudinal tube.

Typically, the motor is an electric motor and is housed in a handle which handle has an actuation switch for the motor mounted therein. Typically, the power tool is of the rechargeable type and the electric motor is powered by means of rechargeable batteries or cells housed within the handle.

Typically, there are between three and five of said longitudinal tubes, preferably four.

The present invention is suitable for application to power drills however they are powered whether full or stepped mains electricity, battery (cordless), pneumatic or any other sources.

The above and other aspects of the present invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 shows in perspective the external appearance of an embodiment of a drill in accordance with the present invention;

Figure 2 is a part cut-away view of the embodiment of Figure 1 showing the handle/drive mechanism;

Figure 3 illustrates the main body of the drill (drive mechanism omitted);

Figure 4 illustrates actuation of the main body (drive mechanism omitted);

Figure 5 illustrates a complete shuttle assembly;

Figure 6 shows the shuttle assembly of Figure 5 in an exploded view;

Figure 7 illustrates the shuttle assembly of Figure 5 and its return spring arrangement;

Figure 8 is a front view illustrating the containment of the shuttle assembly return springs;

Figure 9 is a cut away view illustrating the internal components of the embodiment of Figure 1; and

Figures 10 to 15 are sections through the central plane of the drill of Figure 1 illustrating sequentially the operation of the drill.

Referring to the drawings, an embodiment of a power tool in accordance with the present invention is shown generally at 10 in the form of a power drill having a handle unit 11 with a conveniently placed on/off trigger 12 and a main body assembly 13 being arranged in a conventional manner at about 90 degrees to the handle assembly, with a first chuck 31a shown at opposite end. The overall dimensions, weight and balance thereof are adjusted to be comparable to conventional power drills.

As shown most clearly in Figure 2 the handle assembly 11 of the multi purpose portable power tool house the main drive assembly including means for producing rotational power i.e. an electric or pneumatic motor 14, coupled by means of suitable bevel gearing 20 and bearings 21, 22 and such additional reduction gear as is required to a drive shaft 15 having a spline assembly 16 mounted at its remote end. A central spindle 23 is fixedly attached to the handle assembly and extends in line with and parallel to the drive shaft 15.

A stop in the form of a collar 24 is mounted at the end of the central spindle 23.

The main body assembly 13 of the drill as is depicted in Figure 3, as will hereinafter be described, can be considered to be in the form of a turret assembly and includes four parallel longitudinal tubes a, b, c & d enclosed within a cylindrical outer casing 25. The four longitudinal tubes a, b, c & d are grouped around and attached to a central sleeve 26 mounted for slidable movement along the central spindle 23. The central spindle enables the turret assembly 13 supported upon the central sleeve 26 to rotate about and travel back and forth along central spindle 23, as depicted by directional arrows A, B, C and D in Figure 4. Axial travel away from the handle

unit 11 (in the direction of arrow A) is arrested by means of the stop collar 24 abutting with a collar 27 which is mounted inside the central sleeve 26 at the handle assembly end of the turret assembly. Travel towards the handle unit 11 (in the direction of arrow B) is stopped by abuttment of the turret assembly with handle unit 11. Rotation of the turret assembly around centre spindle is unrestricted as illustrated by arrows C & D when the turret assembly is fully extended away from handle assembly and clear of drive shaft 15 (See Figure 12).

Each longitudinal tube a, b, c, d has a handle end (right hand side as shown in the drawings) and a chuck end (left hand side) and houses a respective shuttle assembly, illustrated in detail in Figures 5 to 7.

The shuttle assembly for longitudinal tube 'a' is representative of all the assemblies and comprises a cylindrical shuttle body 30a having a peg 32a projecting radially from one side thereof at a point generally intermediate the two ends. The peg engages a lateral slot 33a in the longitudinal tube 'a' to limit the lateral movement of the shuttle body 30a within the tube and to prevent rotational movement therein. At each end of the cylindrical shuttle body are provided respective bearings 34a, 35a through which passes a spindle 40a.

At the front end of the spindle 40a is mounted the chuck 31a. At the rear end of the spindle 40a is provided a spigot 41a. A return spring 42a is secured at one end to an anchor 43a within or as shown on the outer surface of the longitudinal tube 'a' and at its other end to the peg 32a of the shuttle body 30a. As shown, the spring 42a is an expansion spring and anchor point 43a is at the handle end of the tube. An alternative arrangement using a compression spring with an anchor point towards the chuck end of the tube could be envisaged.

Figure 8 illustrates the arrangement of return springs 42a, d, c, d for each tube a, b, c, d, within the outer casing 25 showing that each spring occupies one of the quadrant spaces between neighbouring longitudinal tubes and the wall of the outer casing 25. Longitudinal tubes b, c, d have identical internal component parts which

are numbered correspondingly i.e. 30-43b, 30-43c and 30-43d, all operating in exactly the same way as described for longitudinal tube 'a'.

Referring to Figure 9, in operational mode the drill turret assembly 13 abutts with handle assembly 11. Having, for example, chosen chuck 31a for operational duty with a drill bit 50, the drive shaft 15 occupies a position within longitudinal tube 'a' such that the spline 16 engages the spigot 41a of the shuttle assembly. The drive shaft causes the shuttle assembly to adopt its fully forward position, exposing chuck 31a from the end of the tube. Depression of on/off trigger 12 will initiate the drive mechanism enabling chuck 31a to revolve and perform its task. The non-operational chucks are retained within their respective longitudinal tubes in the turret by means of the operation of the respective expansion springs. The tubes are protected from ingress of debris by means of a front plate 51 of the outer casing 25.

Operation of the drill will now be illustrated with reference to Figures 10 to 15. Chuck changing may be carried out as follows:- having completed a first drilling operation (for example with drill bit 50) it may be desired to carry out a countersinking operation as the next stage. To initiate this procedure chuck 31a must be returned to its "dormant" position. Turret assembly 13 is moved forward in the direction of arrow A (Figure 11). Chuck 31a will become "dormant" when the turret assembly is extended fully forward as shown in Figure 12. In this forward or open position, the turret assembly is now clear of drive shaft 15 and is free to rotate. Upon rotation of turret assembly in direction of arrow C chuck 31c comes into alignment with the drive shaft 15 (Figure 13). Chuck 31c may now be advanced from its "dormant" position and called into operation by returning turret assembly to the closed position (in direction of arrow B as shown in Figure 14). Upon closure, chuck 31c becomes engaged with drive mechanism and is exposed from longitudinal tube 'c' with the countersink bit 52 ready for use (Figure 15). Chucks 31b & 31d remain "dormant" throughout preceeding operation and are omitted from Figures 10 to 15 for clarity. Any of the four chucks may be selected following similar procedure to above, and may be repeated continuously as desired.

Each chuck can be pre-loaded with the required drill or screwdriver bit and can be called into operation to perform a different task easily and quickly.

## CLAIMS

1. A power tool comprising a plurality of parallel longitudinal open tubes arranged for rotation about a longitudinal axis within a housing; wherein each longitudinal tube houses a chuck assembly, mounted for axial movement therein, each chuck assembly being selectively operatively couplable with a drive means.

2. A power tool as claimed in Claim 1 wherein each chuck assembly comprises a cylindrical body having an axial spindle passing therethrough with a chuck mounted at a front end of the spindle.

3. A power tool as claimed in Claim 2 wherein the drive means comprises a motor operatively coupled to a drive shaft, the drive shaft and the rear end of each spindle including cooperative engagement means.

4. A power tool as claimed in Claim 3 wherein the cooperative engagement means comprises a spigot and a spline.

5. A power tool as claimed in any one of Claims 2 to 4 wherein each chuck assembly cylindrical body includes a peg projecting radially therefrom engaging an elongate axial slot in the longitudinal tube.

6. A power tool as claimed in Claim 5 wherein a spring is coupled between the each peg and a respective anchor point provided on the respective longitudinal tube.

7. A power tool as claimed in Claim 6 wherein the spring is an expansion spring and the anchor point is located at a point towards the rear of the longitudinal tube.

8. A power tool as claimed in any one of Claims 2 to 7 wherein the motor is an electric motor and is housed in a handle which handle has an actuation switch for the motor mounted therein.

9. A power tool as claimed in Claim 8 wherein the electric motor is powered by means of rechargeable batteries or cells housed within the handle.

10. A power tool as claimed in any preceding claim wherein there are between three and five of said longitudinal tubes.

11. A power tool as claimed in Claim 10 wherein there are 4 longitudinal tubes.

12. A power tool substantially as herein described with reference to the accompanying drawings.

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**Application No:** GB 9916570.6 **Examiner:** Dave Butters
**Claims searched:** 1-12 **Date of search:** 2 November 1999

# Patents Act 1977
# Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B3C

Int Cl (Ed.6): B23B, B25F

Other: WPI, EPODOC

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | Relevant to claims |
|---|---|---|
| A | GB 0890368 A ( KEARNEY ) | |
| A | US 5022131 A ( HOBBS ) | |
| A | US 4945790 A ( GOLDEN ) | |

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|---|---|---|---|
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